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Assessment Of Water Supply In Gondar Town, Ethiopia: Challenges And Prospects

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Abstract

Gondar town has been through a problem of sustainable potable water supply in the past ten years. Even if the modern water supply system was installed since 1930's and has been expanding its service in the coming years, still the demand is not satisfied and large number of people do not have access to adequate amount of potable water. As a result residents are forced to get water from unprotected sources which are far from their homes. Besides, they also buy water frequently from illegal persons and incur additional cost. In line with these the main objective of this study was to assess the magnitude of water supply and its challenges and dynamics associated with unsustainable water supply in Gondar town. A survey was conducted on a randomly selected 120 House Holds and interviews with purposefully selected key informants.

Emphasis was put on examining the nature of the problems of water supply and challenges the service providers and households faced. The study has confirmed that the town water supply service could not cover the demand of it with present existing capacity and based on the research outcome only 43.3 % of the respondents get water through their own private taps. All areas of the town could not get equal and proportional service and the tariff set is neither fair among the poor and rich households nor generates sufficient revenue to cover investment costs. The root causes of the challenging problems are institutional, financial, human and material resource constraints. That is, the water supplying service in the town is unsustainable; it is socially inequitable, economically inefficient and environmentally unsound. This study presents the following recommendations to ensure sustainable water supply in the study area including synchronizing different water sources, conserving water sources, family planning, demand management, demand oriented supply, participating different actors, mobilizing financial resources, and staffing organizational structure with skilled personnel and equipping it with material facilities.

Key words: Water sources, supply and demand, production, distribution, consumption, accessibility, willingness to pay, cost recovery, sustainable water supply: Gondar.

Background

The challenges facing many countries in the world today in their struggle for economic and social development is increasingly related to water. According to Antonio (2005), more than 1.2 billion people in the World still lack access to safe drinking water and 2.6 billion lack accesses to even basic sanitation.

Particularly, of any region in the world, the problem of water supply is deep rooted and multi-dimensional in Africa. In the year 2000, World Health Organization (WHO, 2000) estimated that Africa contains 28% of the world's population without access to improved water supplies. Even though Africa is stated that it is currently urbanizing rapidly and by

2020 it is expected that over 50% of the population in Africa will reside in urban areas, more than 30% of the residents in urban areas currently lack access to adequate water services and facilities (Water Utility Partnership, 2003).

Similar to the urban water sector in many developing countries, there are serious constraints in meeting the challenge to provide adequate water sustainably for all urban residents in Ethiopia. Water

supply shortages and quality deteriorations are among the problems which require greater attention and action. Various strategies are always being developed to make water accessible to all inhabitants. However due to insufficient
structures coupled with rapid population growth and urbanization, the gap between demand and supply of water continues to widen (Degnet, 2011). The situation in the study area, Gondar town, is not different from such realities.

In Gondar, which is a historical town and currently one among the big cities of the country, the problem of sustainable water supply has become a common feature since the last two decades. Even though, there has been drinking water supply service since the Italian five year colonial occupation of the area, it had not been meet the needs of the residents in any of these times.

The first modern drinking water service for the town started in the late 1930's during the five years Italian colonial occupation. This first water supply system was constructed on

Koremerem Spring in 1945. Until the town's water supply system was improved in 1968 by Yugoslavian, Koremerem had been the main source of water in the area for more than two decades. The Yugoslavian system improved the town's water supply system by adding one deep well to the existing Italian system. However, supply from these sources was not able to feed the increasing number of residents of the town later than mid of 1970's, as a result it urged the Angereb Dam and treatment plant Project which has been constructed from 1983 up to 1993 by Water Works Design and Supervision and Ministry of Water Resources (MoWR) cooperation with a total water holding capacity of 5,000,000m^3 including the drilling of 8 other boreholes (Gondar town Water Supply Service Report, 2012).

Although the City Administration has been taking different measures in different times to avert the situation, still there are many problems related with drinking water supply. Water supply is intermittent; particularly during the dry season (February to May). The per capita water consumption in the town is 32 liters/day which is inadequate for different household activities and the total service coverage currently is only 45% (Gondar town water supply office report, 2012). In short, the clean drinking water supply service in the town is unreliable and still a large number of people lag behind from access to drinking water supply service.

In short while a sustainable water supply is one that ensures adequate and equal distribution of clean water to all residents, give priority for customers' selection of service type, considers economic viability of various society groups and well functioning of the whole ecosystem, the situation of water supply in Gondar town is out of the consideration of all these points and the sustainable supply of water have never been achieved in the town's history of water supply service.

In fact, different researches have been conducted in the town in relation to water supply including environmental sanitation and extent of bacterial contamination through the different sources of water, but none of these studies addressed the concern of water sustainability. Therefore, this study will investigate factors that affect the sustainability of water supply in the study area. To this end, it will bridge the existing research gap and come up with different planning solutions for the sustainability of the service.

The main objective of the study is to assess the challenges of sustainable water supply in the study area.

Methodology And Materials

For this study, base map of Gondar Town was used to make investigations on the location of water sources and their contributions for the existing problem and to identify the new residential and squatter settlement areas and check the presence of pipe lines accordingly.

This research used to collect, generate and analyze relevant data on the existing water supply condition in the study area and on factors that impede the provision of safe and adequate water supply and its socioeconomic implication on the community using descriptive and exploratory methods.

All the necessary data required for the study were obtained from both primary and secondary sources. The major sources of secondary data were from government and non-government publications, annual and inventory reports, previous studies, and books. Whereas the primary data were collected from sample households, Focus Group Discussion and Key Informant Interview which were made with various stakeholders, community representatives, water service officers, City Administration and other concerned and affected bodies. In addition, personal observation and informal discussion with users were also the other data sources which reinforced the required data from the study area and served as a check for data reliability.

One of the central objectives of this thesis was investigating the magnitude of water supply and its dynamics and challenges in Gondar Town; to this end to get the representative population and the necessary information accordingly, this research used the combination of random and purposive sampling techniques to select household respondents, Focus Group Discussants and Key Informants. Random sampling was applied to select the sample households to get representative informants whereas purposive sampling was used to select the sample kebeles, Focus Group Discussants and Key Informants.

Data on factors that may hinder the sustainable functioning of water supply schemes were gathered through employing multiple methods including Questionnaire, Focus

Group Discussion, Interview and personal observation were being vigorous instruments to directly observe the existing water supply problems in the study area. Prior to the actual collection of data, pre-testing of the materials was made to check its validity and clarity. The pre-testing of the questionnaires actually helped in the administration and implementation of the actual survey and in restructuring the questionnaire format and content.

To analyze the data collected a combination of quantitative and qualitative analysis methods were employed. Quantitative data which was generated from household survey were analyzed using simple descriptive statistical tools like frequency, mean, standard deviation and percentages and they were operated with Statistical Package for Social Studies (SPSS) and Micro Soft Excel. The qualitative data collected using Key Informants Interview and personal observation was also analyzed through description, narrating and interpreting the situation contextually so that the town's water supply situation has been properly revealed.

Major Findings

Based on the discussion with the owners of the boreholes, the use of water from these boreholes is more common in times of water interruption and dry season. In these times the water from the bore holes is not only used by the owners but residents from the neighborhoods and sometimes people in distant kebeles buy this water and use it for various domestic uses. As per the respondents view mainly water from rain harvesting and boreholes are used for other domestic activities like washing and cooking, though sometimes it is used for drinking particularly in times when the interruption stays long for weeks.

In the study area there is a serious water supply problem. According to the information gathered from GTWSSO, sample respondents and as observed on the field, the residents get tap water twice a week (sometimes once a week) only for a few hours. In places like Arbegnoch Adebabay, Gbreal, Adebay Eyesus and Lideta area where the

topography is a bit higher, the water has no power to reach to the top. These HHs get tap water once a week for few hours.

It is stated that safe water supply is a platform for the wellbeing of individuals and further development activities. One of the basic objectives of providing piped water is to make available to the consumers pure and wholesome drinking water. However, the absence of this crucial element In Gondar forced the inhabitants to use different alternative sources which have exposed them to waterborne and water washed diseases in different times. Water in the whole parts of the study area do not continuously flow in each individual's house at any time, at a required amount and is not accessible everywhere.

Regarding water born diseases, the output of the household survey and the information from the Focus Group Discussion shows that even though particularly in recent years the quality of water is a bit getting better and better, but still because of the low amount of water received per day, sometimes water washed diseases occur in the area.

Based on GTWSSSO, 2004 report, physical, chemical and bacteriological water analysis is regularly carried out. As per the information obtained from the Laboratory technician, the water quality tests are carried out twice a day for physical data, 5 times a month for chemical data and every 3 days for bacteriological data. To keep the quality of the water good, these are the most common chemicals currently used for water treatment: Aluminium sulphate, Calcium hypochlorite, Sodium carbonate (soda ash) and Copper sulphate.

According to unstructured interview made with some residents, still water born diseases occur sometimes which may be arise because of carelessness of the water experts. Based on Gondar town water office report, 2012, Very rarely, coli have been detected. This might be related to local mixing of tap water with sewerage water from pit latrines. It should be noted that some of the pipelines in the city are very old that are fitted by the

Italians in the 1930's when the first pipe system introduced to the town. Moreover, because of the low amount of water the residents are providing, water washed and water related diseases like diarrhea, jardia, and typhoid occur very likely.

The main source of water for the town of Gondar is from Angereb River Dam and

Treatment Plant and boreholes developed in Angereb Valley.

At present, the city of Gondar is mainly supplied by surface water (Angereb River), which constitutes about 84% of the supply, and groundwater

The construction of Angereb Dam and Treatment Plant was commenced in late 1986 by constructing an earth fill dam across the Angereb River at about 2.3 km east from the center of the town. According to the study of the project, the reservoir impounded by the dam covers a total watershed area of 7,624 hectares to collect sufficient amount of raw water that can serve about 275,000 people of Gondar for 20 years. Although the project was planned to start its operation in 1988, it had started its actual function in 1994 after a six year additional construction period.

The system of distribution is the most important aspect of water supply in any community. The type and efficiency of water supply system greatly affect the rate of household consumption. The process of distribution starts from the place of production or the source of supply, in this case from the dam and boreholes.

Raw water from Angerbe Dam is lifted to the rapid sand filtration treatment plant by the raw water pumps installed in the intake tower. After the water is chlorinated, the clear water is send to the clear water tank through gravity. Water from boreholes in Angereb Valley is also pumped into this clear water tank. The water is then lifted to Debrebrhan Silasie Reservoir by four duty and two standby centrifugal surface pumps.

The water distribution system of the Town contains service reservoirs, distribution pipes and pressure break tanks at different locations. There are two transmission mains conveying water from point

of production to reservoirs. The first main is running from

boreholes situated in the Angereb field to the Clear water tank in the compound of the treatment plant and the second main is the one conveying water from the clear water tank to Debrebirihan Selassie Reservoir.

The distribution system of the Town is subdivided into eight zones. Through each pressure zone is supposed to have its own dedicated reservoir and distribution pipes, some of the distribution pipes of different zones are interlinked making the system inefficient. Besides, there is no well documented map showing the extent of each distribution line and the service boundary of the reservoirs. According to an inventory report of the GTWSS office, the total estimated length of distribution pipes in the Town is greater than 120km with varying pipe size.

Obviously, the importance of reservoir as part of the distribution system is to guarantee a continuous supply of water at the time of interruptions in the process of production.

This indeed, depends on the number and capacity of reservoirs and on the relative ground elevation where they are situated, if water is to be distributed by gravity.

The distribution system covers mainly the older and central part of the town including

Medihanealem, Adebabaye Eyesus, Mahal Arada, Abiyegzi, Aba jale, Gebreale and Ledeta Akababi. As per the official data of GTWSSO report, 2012, currently the office has a total of 18,166 customers of which 16,559 domestic, 1,188 commercial organizations, 370 governmental and social institutions, 20 industries and 29 gas stations. Although this number is increasing from time to time, still many lags behind from getting water through private meter connections.

Based on the standard indicated on Growth and Transformation Plan for urban water accessibility, which is 20 liter per day per person in 500m radius, the office achieved 100% service coverage. But the same report has indicated that, for towns like Gondar the major indicator should be water demand coverage. Based on this currently the water demand in Gondar per person per day is believed to be 75 liters this in turn refers the existing water supply service coverage is only 43%.

Inhabitants who do not have access to the piped system draw their water from vendors, private hand dug wells or somewhere else that have their own private connection and selling it at a higher price.

The spatial extension of pipeline over any settlement area is surely a pre-condition for supplying the community with piped water. The efficiency of water supply is therefore, determined primarily by the density of pipelines which are in turn influenced by other socioeconomic and physical factors. Among these factors, the number and spatial distribution of public water points, regularity of water supply and the income level of the community are the major ones.

In spite of its importance, the spatial distribution of pipelines is confined to some parts of the town. Most parts of the peripheral built up areas of the town are currently beyond the reach of pipelines. The implication of this is that people living in these areas of the town highly suffer from the absolute absence of water supply around their residence.

They usually go far off distances in search of water and carry it along and also spend much time even in queuing up near the water taps.

Although there is no any map about the density of pipelines, based on unstructured interviews with different respondents it has been observed that the pipeline network is unfairly laid, denser at the center and sparser at the peripheries. According to the information collected through interview, Pipelines density in non-residential areas except government built residential areas the so called Condominium houses and hotels

(commercial and administrative areas), is relatively greater, since priority is often given to such areas where private and government organizations which can afford the installation costs are located.

The problem of line extension is further aggravated by steady and rapid spatial expansion of the built up area. The challenges that are encountered by the community due to the absolute absence of water

supply around this new built up and peripheral area is the highest burden of people per public water points. This implies that many people are queuing at water points for a long time in areas where they are working.

Distributing water through house connection use is obviously the most convenient system of water supply for households. However, the installation of the residential meter connection involves much higher cost which most of the households in the community under consideration (the poorest of the poor) could not afford. For example even though the fee for meter connection varies according to the house's distance from the main distribution pipelines, the payment for houses that only requires single pipe is 1600 ETB which is unaffordable to many residents. Because of such financial and other socioeconomic factors, the rate of private meter connection for household service in

Gondar town is very low but increasing from time to time.

The implication of this finding can be expressed in terms of principles of optimal use of water, equity of access, efficiency of use and sustainability of the source. The first implication is that high variation in number of households with and without meter connection shows there is no equity of access to potable water supply. The second implication is that available water is distributed to fewer numbers of the community in large amounts rather than administering to the majority of the community in small amounts so that the few community with large amount of water supply can use consume water as they wish without giving due consideration to waste of water. Eventually such unequal/unfair distribution of water leads to inefficient use of water by few numbers of the community. Last but not least, the majority of the people did not get adequate potable water means they are forced to use other alternative sources. This consumption characteristic of water implies absence of optimal use in terms of sustainability of the source in the study area.

Variation in the proportion of households with meter connection service might have emanated from differences in income level of HHs, pipeline density and distance from the source of water supply. Due to such constraints households face serious shortages of water supply. They, therefore, collect water for any kind of household use from other sources or from water vendors which obviously costs them a considerable time, energy and money.

The impact of this is that households lost their income and time which led to low productivity, burden on home duties and drudgery especially on girls and women.

However, the issue of fairness and full cost recovery is still paradoxical to solve such problems of variations in access to social services including potable water. Charging high tariff to cover the full cost means the poor cannot afford the charge. Again when low price is set or water is provided freely, revenue becomes low thereby resulting in inability to cover the full cost and to sustain the service unless it is subsidized by the government.

The Ethiopian Water Resources Management Policy also clearly emphasizes government subsidy is becoming out of the question. This modality is in order to provide efficient and sustainable service through a sound financial and technical management of the system. The policy has also given concern to the ability of the poor to pay by the term (category of) "social tariff" in which the poor are charged less by assuming that the well-to-do consumers will cross subsidize water supply

In urban communities the problem related to household water consumption patterns involve various components even though its effects vary from one urban center to the other and among communities. Among other factors physical and socioeconomic factors are the major ones.

The rate of water consumption in a particular area is a function of various factors. The first and the most influential factor which has been affecting water consumption in Gondar town is the nature of the source of water with respect to quantity. Low quantity was expressed as a more serious problem by

different sections of the society interviewed for their water consumption.

The other physical factor which affects the use of water within each household is the physical distances of housing units from the water point. For instance "Bono water" users walk average distance of 357.8 m for a single trip. The total number of stand pipes in the whole town is not more than 30, which mean that almost one for a kebele in previous system of the town's administrative division but the worst thing is from these currently only 5 of them are giving service. Thus this distance is greater than the reasonable access defined by the World Health Organization (WHO) in Assefa

(2006:69) to safe drinking water in urban areas i.e. 200 m for the housing unit.

It is observed that the average water consumption per individual per day for houses with private meter house connection is 37.06 liters whereas, for houses using public standpipes it is only 26.1 liters. From this it can be concluded that physical distance of the housing units from the water point had an inverse relationship with the amount of water consumption despite other factors affecting water consumption such as purchasing power, household size, and household income. The average per capita water use of member of each household was calculated and it was found that 31.29 liters of water per day. This amount is almost similar to the per capita amount the WSSO indicate in the 2012 yearly report, which is 32 liter.

The rate of water consumption also depends on the pressure of the water system, which is dependent of continuous power supply. One of the problems of water supply system in Gondar town is the inadequacy of pressure to satisfy the need of people.

Pumping distribution method needs energy to force the water from the sources to the mains and then to the consumers even though gravity system is there also. This incurred power cost. In addition to this, power failures mean a complete interruption in the water supply system and then less consumption. Most of this interruption occurs in the dry season when consumption in reverse increases. This is because of the fact that, water table decreases from the sources especially in dry season (Bega) .When such unexpected power cut or failure occurs and complete interruption is caused, the households faced different challenges that in turn lead to low productivity, low income and poverty.

It can be visualized that the households in the study area get a very little amount of water for their daily water needs and in any criteria these per capita water use values are very little.

According to UN-HABITAT (2003) a household needs a minimum of 150 l/ day and for good hygiene up to 600 l/ day. Obviously domestic consumptions in cities differ mainly due to climate, standard of living, household size, etc. But from this study it can be concluded that the per capita water usages of the study areas are rather very low and needs to be improved.

Water accessibility is an adequate amount of water, which is needed to satisfy metabolic, hygienic and domestic requirements at least 20 liters of safe water per person per day (UNHABITAT, 2003). In urban areas the water source may be a public fountain or a stand pipe at least 20 liters of safe water per person per day and not more than 200 meters away from residence (WHO 2004). In addition to adequacy, affordability of water also has significant influence on the use of water and selection of water sources. Households with the lowest levels of access to safe water supply frequently pay more for their water than these households connected to a piped water system. Beside high water cost forces households to use small quantities of water and alternative sources of poorer quality that represent a greater risk to health (Public Health Protection, 2000).

Furthermore, high costs of water may reduce the volumes of water used by households, which in turn may influence hygiene practices and increase risks of disease transmission.

Now from 30 stand pipes only 5 are working and most of them are found in sub-urban and outer kebeles of the town where private meter connections are not reached and there are no other options. From

these working pipes, 2 of them are found in kebele 18 (Maraki) one of the sample kebeles of this study

It was also found that households pay on average ETB 45 / m3 for vendors, which is about 8 times the unit cost set by GTWSSO for public taps. Households spend on average ETB 0.37per capita per day on water. In general, this per capita expenditure by the households is high and clearly shows how much the service is unaffordable.

It has indicated that, because of the fact that, Gonder is the only town in Amhara region which is using surface water for drinking purposes, it is known, the tariff is even the highest in the region. One major problem of utilizing surface water is, as they are highly exposed to turbidity and contaminations, it always imposes high chemical cost. As a result of this to compensate this expenditure it is a must to higher tariffs until the level it could pay back. In addition to this, because of the reason that Angereb dam and treatment plant are found on low altitude in relative to the town, water is distributing using electric power pressure, so the office's electric expenditure is very high too. Plus to this currently according to GTWSSS report (2012), the office's annual expenditure (10,508,000 ETB) exceeds its revenue (6,409,000 ETB) and it is not able to cover its coasts. Therefore it is not easy to lower the tariff below the current amount and even it has raised as shown in the table 4.14 above in the proposed new tariff.

Theoretically, when people think there is some value achieved over something, they start to take actions to preserve it in order to maintain for a long period. In order for the inhabitants to meet the costs of operation and maintenance, people must be willing and able to pay for the service. This is why a survey is suggested to be done to determine the community's capacity and willingness to pay.

The survey result revealed that households are willing and able to pay more than what they were paying. Similarly, the data collected from Focus Group Discussion discussants confirmed that users of water supply systems are willing and capable of paying for the improved service. This was because, as indicated by the Focus Group Discussion discussants, the inhabitants were not satisfied with the current water supply service for a long period of time, almost for a decade. There were also lacking of transparency and accountability in fund management in GTWSSSO.

The different sources of water are not synchronized: conserving or recharging natural ground aquifer such as afforesting water catchments areas that can regulate flow of water is not exercised. The role of indigenous trees in protecting watersheds from overall ecosystem devastation and ecological degradations are totally forgotten by the WSS office. Moreover, curbing waste water and reusing for different purposes is not introduced to the community.

Unfair distribution of Water is the major problem in the town's WSSO. The rate of meter connection and the spatial distribution of public standpipes or water points do not meet the demands of the community. The distribution system covers mainly the central part of the town; government built residential areas and the area where different organizations are concentrated. Most parts of the peripheral built up areas of the town are currently beyond the reach of the pipelines. When we see the spatial distribution of public stand pipes in the town, it is unfair. Their distribution in the older and central kebeles and in the new and peripheral built up areas is not proportional.

The problem of water Loss as a result of leakage is among the major causes of the widening gap between water demand and supply in the study area. In addition to the under capacity rate of production which lowers down the actual production of water supply, water loss has further reduced the amount of water supply that can reach the customers. This challenge is exacerbated by choice of inappropriate technologies that cannot meet appropriate standards. As observed from the field, in Gondar town water supply system still there are old pipes serving in distributing water that lay down during the introduction of piped water in the town for the first time by

Italians in the 1930's. Even though most of the older pipes are removed at different times but still there are many continue serving problem fully. The expansion work on the town's sewerage system is also the other factor to the aforementioned problem. In many parts of the town the surface was dig and many

pipe lines were broken. Plus to these causes the construction of cobble stone roads in the town's inner access roads has played its own significant role in the intensifying leakage problem.

The water tariff set by the Gondar WSS office and the Board of Gondar town water supply for private connection and its connection charges is unfair to the poor segments of the community. This is because of the fact that those who consume more volume of water pay low price due to the price set in this manner and also the high connection charges. This implies that the tariff subsidizes the urban rich, as they are the one that can afford and consume more than the poor and can also sell from their private matter for the poor at a higher price than the price they paid for WSS office. The payment for the installation of new meter connection lines is not affordable for poor households. The minimum fee is 1600 ETB which is very expensive.

Various physical and socioeconomic factors limited water consumption by households in Gondar town. To mention some of them: inadequate supply, the physical distance of housing units from water points, unreliable distribution due to weak pressure and frequent interruption etc. Among these factors, which limit the amount of water consumption, interruption of water supply is a more serious problem.

During unexpected water supply interruption households encounter multidimensional problems as mentioned in the preceding sections. The growth of the town in terms of population, household size and income has also its own influence upon the water consumption by households.

Obviously, for water supply services to be sustainable, they should be efficient, equitable and accessible (in terms of distance, time and affordability) to all members of a given community. This in turn requires an abundant water resource, a well conserved and functioning ecosystem, sufficient material, capital and man power resources, advanced and up-to-date technology, organizational and institutional capacities. Because of the shortage of these factors, the water supply service of Gondar town is not sustainable mean it is inefficient, inequitable and inaccessible to significant proportion of the society. Condition of the factors in the study area are explained in the following way Management problems: management problems caused by inefficient organizational structure, understaffing, low salaries and lack of staff motivation and inability of the WSS office to retain trained and experienced staff is the main constraint to service delivery.

Major stakeholders in Gondar town water supply activities, have no coordinated linkages among the Regional water bureau and WSS office except for technical support, implementing construction works of water which is its responsibility and in Board decision in which the Town's mayor is the chairman.

Different professionals are not incorporated in Board members to exploit their technical knowledge. The community is represented by the two-delegated members. Thus, the poor institutional coordination hampered the efforts to achieve WSS office goals.

Delivery of urban water supply requires a high level of investment. Lack of sufficient funding has limited the quantity of water supply service of the WSS office. Even though, the current cost recovery mechanism of Gondar WSS office seems better and able to cover expenditure costs it is not sufficient enough to invest in some areas and to sustain even the existing service and fulfilling its mandates.

In the WSS office there is no much focus to natural resource conservation works. Even though it is believed that a rational utilization of all the natural resources within the watershed is necessary for optimum production to fulfill the present need without or with minimal degradation of natural resources such as land, water, and environment through proper participation of communities, the offices less emphasis to the occurring soil erosion and land degradation clearly shows the lesser attention it has given to sustainably manage the watershed. As the general manager Mr. Yirga mentioned, the office do not have an annual budget for soil and conservation works and except the recently community campaign for soil and water conservation work in the whole country, there are no conservation works by the WSS office.

Inadequate equipment facilities and other material resources are a critical issue faced by the WSS office. Chemicals and spare parts for the pumps of bore holes do not easily provide to the concerned

bodies. The workers do not have sufficient place to work relaxed in the treatment plant. They have only one narrow room for everything office, store and chemical coagulation which is dangerous for workers health.

Even when the office is capable of providing the required money, there is a problem of delay in purchasing the materials. In addition to this shortage of skilled manpower further exacerbated nature of the problem. These constraints are the most limiting factor in the fulfillment of its desired service provision. During field observation the researcher has observed that four among the eight bore holes were not functioning because of mechanical and electrical failures and they were waiting for higher technicians from the Regional Water and Energy Bureau.

Plus to this there aren't adequate capacity building activities in the office. To work efficiently workers have to be provided continuous trainings related to their professions but currently except some trainings given from the Federal and Regional Water bureaus very rarely there are no regular trainings and capacity building works.

Limited community participation in decision making: Individuals and communities, the private sector and NGOs have very important roles to play in the implementation of WSS activities and in achievement of water supply schemes. However, there is no participation of these important stakeholders in Gondar town water supply service activities except the two community members participating during Board decision. WSS office is the only mandated government body to supply water for Gondar town inhabitants to satisfy their needs. Thus, it is difficult for WSS office alone to meet the ever-growing demand of the population. Involving the community during planning, implementation and operation phases of the scheme and delegating those helps to create a sense of ownership to ensure the sustainability of the water supply scheme. In addition to this, it is also important to establish a water committee with membership of women and well developed reporting format and system to get feedback on issues of water supply.

Conclusions and recommendations

The water supply of adequate quantity and acceptable quality is one of the basic needs of human beings, but the provision of potable water in Gondar town is inefficient. The situation is getting worse due to the population growth and spatial expansion of the town which outstripped its ability to supply sufficient water for its inhabitants.

The existing sources of potable water are both surface and ground water which reach the customers or end users through Private meter connection and public water points. However, since the sources decrease in amount, especially during peak dry season, the amount of production is not adequate even for those who have access to it. The amount of production is also further reduced by less well working hours, limited number of boreholes and through losses including mechanical, frictional and head losses and leakage.

The water tariff set in the town is not properly formulated and does not enable the office to cover all costs including the investment cost of the service to fulfill the principles of cost recovery. This is because of the fact that the price does not charge based on volume of water consumption. After a certain limit of consumption the customers pay the lowest price for higher volume of water consumption. Such price charging, subsidized the rich and favored water vendors. The majority of the victims of the problem are the poor as they cannot afford the connection charges.

Thus, it is observed that the water supply approach in the town concentrates on traditional systems of service coverage, service pricing and mandated institutional arrangements for service delivery rather than identifying a self selection of the service type, consumers' willingness to pay, consumption based service charging and emerging partnerships with NGO, CBOs and private sector.

Because of these poor functioning of the existing water supply service most of the households in

the town are willing to pay higher prices for an improved water supply service if the government provides it. This prevalence of willingness to pay implies two things: there is further demand and the existing water supply service is not convenient for the customers. They have the ability to pay if water is provided in a relatively higher price than the current one. This shows that, WSS office could have been generated sizable revenue if it could provide a better water supply than the existing one.

Hence, the problems of water supply in Gondar town are multidimensional in terms of both efficiency and equity. Among the challenges identified inadequate water supply, inequitable and inefficient distribution system, low coverage, unfair price and the resultant limited consumption are the major ones. These problems imposed different challenges on inhabitants such as loss of time, energy and money; exposure to waterborne and related diseases which penalizes the poor medical cost and pay high price for water vendors.

The causes of these problems and challenges are to some extent resulted from management problems, under staffing, lack of sufficient funding and capacity and the absence of community, private, Community Based Organizations, and Non Government Organizations participation in the implementation of Water Supply Service activities.

In summary, while a sustainable water supply is one that considers customer selection of service type, equal distribution of water among various social groups, economic viability of different community members, meeting national and international drinking water standards, full participation of the society and presence of a well protected and functioning ecosystem, the situation in the study area is different. There are large number of people waiting for private meter connections in the suburban part of the town, travel long distances every day and take much time to fetch water, the tariff does not charge the poor and riches fairly, there are no ways through which the community as a whole and women in particular to take part in the planning, implementation and decision making processes and at large there are no environmental protection and conservation works to provide water for the society at the required amount constantly. Therefore, the water supplying service in Gondar town in general is unsustainable; it is socially inequitable, economically inefficient and environmentally unsound Improving the existing water supply service in the town in terms of quantity, reliability and sustainability means upgrading the socioeconomic welfare of the people in the town hence the authority should focus on it

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